ACUMEN INSTRUMENTS CORPORATION

DataBridge SDR2-USB
REC
FAULT
DATA
REC
PWR

DataBridge™ SDR2-USB

Configuration Guide

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Getting Started

1.1 Overview

DataBridge SDR2-USB serial data recorders record RS-232 serial data to industry-standard mass storage using an Microsoft Windows™-compatible FAT file format. The SDR2-USB is equipped with a USB 2.0 socket and is designed for use with USB storage media such as USB flash memory keys.

During Record mode, the SDR2-USB's *data port* accepts RS-232 serial data from your data source. The SDR2-USB data port supports baud rates up to 921600 bps and RTS/CTS hardware handshaking for reliable high-speed communication. Your SDR2-USB is also equipped with a real-time clock, power-saving features, non-volatile memory, and a resume-on-power failure feature. The SDR2-USB features a one-button front panel user interface that starts and stops recording.

NOTE: The *data source* is a device that transmits serial data for use by a computer, printer, or data logger.

SDR2-USB configuration is performed by editing a setup file on the USB storage device.

1.2 Before you start

Before you start, be sure you have the following items available:

- DataBridge SDR2-USB
- A 5-30VDC power supply
- RS-232 DB9 serial cable
- The device you wish to record from (serial data source)

1.3 A quick guide to the DataBridge SDR2-USB

On the front of the SDR2-USB are the USB "A" socket, record button, and LED indicators. The SDR2-USB can be toggled in and out of record mode using the record button located on the front panel. The LED indicators show the SDR2-USB's current recording status. The *data indicator* flashes when data is received and is used to verify data reception from your data source.

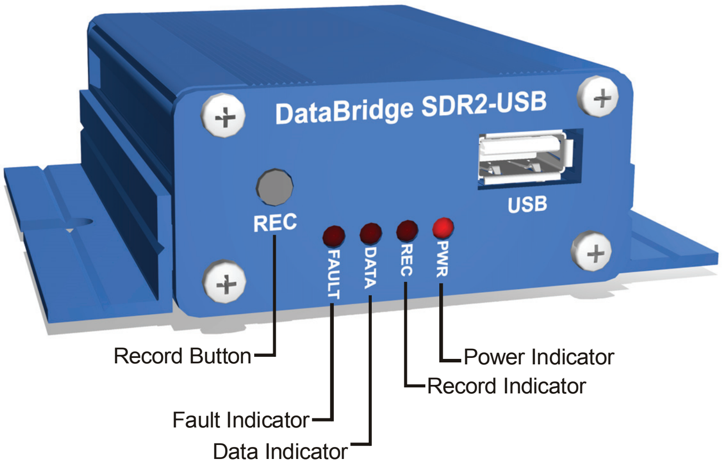


Figure 1.1. SDR2-USB Front Panel Controls.

On the rear is the male nine-pin D-subminiature connector (DB9M) for the data port. The 5 to 30 VDC power input is also located on the rear panel.

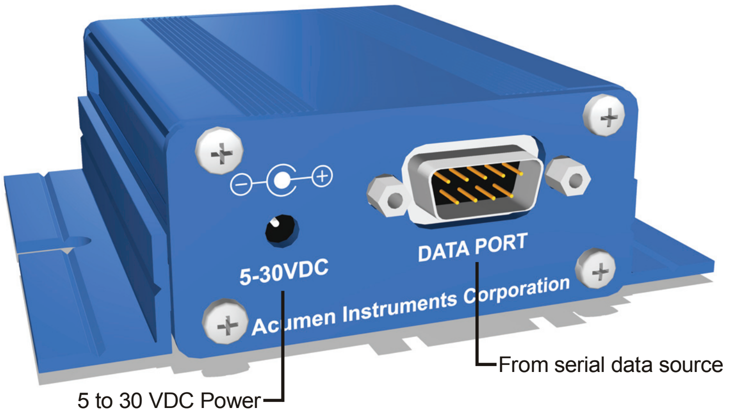


Figure 1.2. SDR2-USB Rear Panel.

1.4 Deploying the DataBridge SDR2-USB

1.4.1 Connecting power to your SDR2-USB

The SDR2-USB starter kit includes a 120VAC power supply that connects via the rear panel. If you use an alternate power source, it should be capable of sourcing at least 1W power. When you apply power the power indicator should light and the other indicators should flash in sequence.

1.4.2 Configuring your SDR2-USB via the setup file

To successfully receive data from your data source, the SDR2-USB must know at which baud rate the data source is transmitting. Configure the recorder for this baud rate using the setup file.

Insert the USB device you intend to use for recording into your PC's USB socket. Usually, Windows will respond by displaying the contents of the device. If this doesn't occur, navigate to the device's drive letter (e.g. J:).

Right-click within your drive's contents in Windows Explorer, then select "New" and "Text Document." When prompted, name the file setup.txt (See Figure 1.3).

NOTE: Your computer's Windows installation may display different drive letters, file types, etc. due to differences in Windows versions, configurations, and software installations.

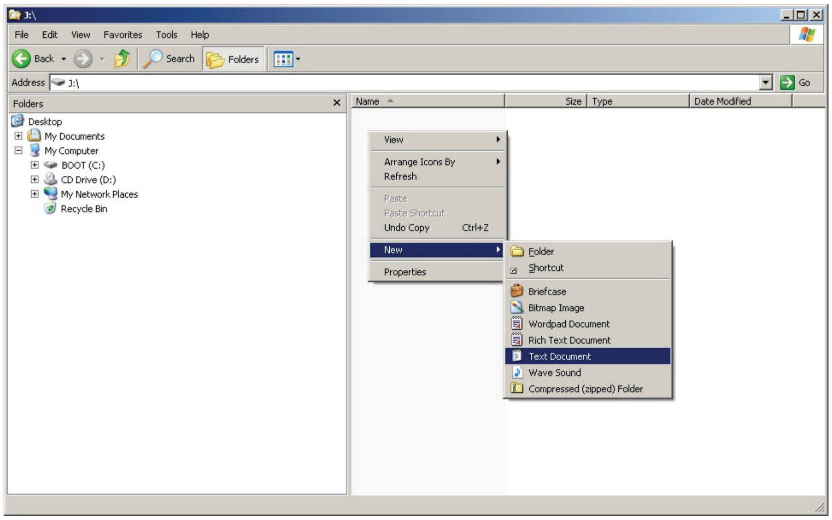
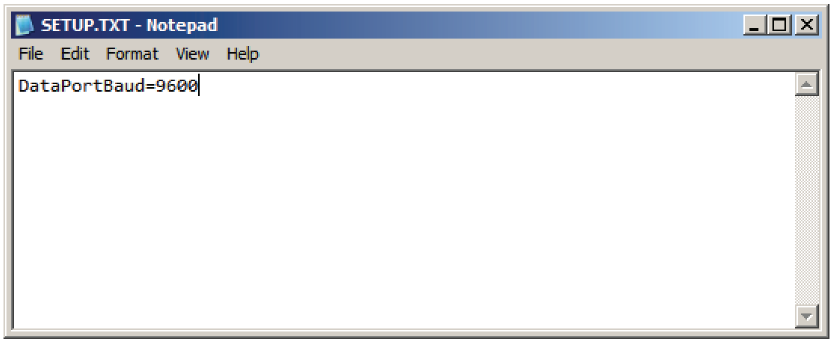


Figure 1.3. Creating setup.txt.

Once the file is created, double-click it to open the file in Windows Notepad and enter “DataPortBaud=9600” as shown in Figure 1.4. This tells the SDR2-USB to communicate with your data source at 9600 baud. The baud rate for your serial data source may differ from 9600 bps.



```
DataPortBaud=9600
```

Figure 1.4. Editing a simple setup.txt file.

Close Windows Notepad, then right-click the USB device’s drive letter and click “Eject” to safely remove the device from your system.

Insert the USB device into the SDR2-USB, connect your serial data source to the DB9M connector, and connect power. The SDR2-USB will display a left-to-right-to-left flashing sequence. If your data source is outputting data, the front panel “data” indicator will flash as data arrives.

1.4.3 Congratulations!

You’ve set up the SDR2-USB to communicate with your device!

2

Configuring the DataBridge SDR2-USB

Now that you've successfully edited the SDR2-USB's setup.txt file, you are ready to configure it for use with your serial data source. Using the setup file, you can:

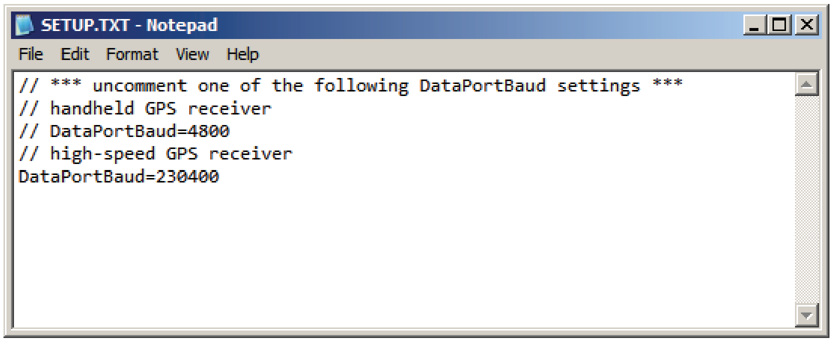
- Set the date and time.
- Configure handshaking and data word format for your device.
- Specify a directory to record files to.
- Specify a filename for recording.
- Select how and when data is written to files.
- Add time stamps to recorded files.

Before you begin, be sure you have the documentation available for the device you'll connect to your SDR2-USB. If possible, be sure you can communicate with the data source using the supplied software and/or your communications software. An intimate knowledge of your data source's communications standards will make connecting it to the SDR2-USB simple.

Note: all SDR2-USB settings are persistent. Changes made via the setup file will be retained by the recorder after power is removed and until they are reversed in the setup file or the recorder is restored to factory defaults (see Section 3.4).

2.1 Comments

Within the setup.txt file, it is useful to record comments documenting the settings chosen and why some configuration choices were made. Comments are also useful for temporarily disabling setting(s) for the purposes of testing multiple settings.



```
// *** uncomment one of the following DataPortBaud settings ***
// handheld GPS receiver
// DataPortBaud=4800
// high-speed GPS receiver
DataPortBaud=230400
```

Figure 2.1. Use of comments to switch between GPS receivers.

To create a comment line in the setup file, place to forward slashes ("//") at the beginning of a line. The SDR2-USB will completely ignore any line that begins with `//`. To disable a particular line temporarily, insert `//` at the beginning of the line.

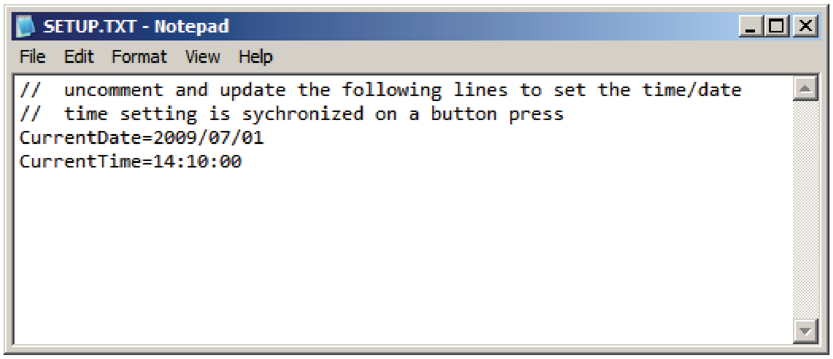
2.2 Setting date and time

The SDR2-USB features a real-time clock that reports a file's last modified date and time. The real-time clock accurate and battery-backed, so setting the date and time is seldom necessary.

Unlike DataBridge SDR products equipped with a configuration port, setting the SDR2-USB's date and time is a four-step process.

Step 1: Edit setup.txt

Add `CurrentDate=` and `CurrentTime=` lines to the setup file (see Figure 2.2) with a time value 1-2 minutes ahead of the current time. The year field must be specified using 4 digits, while all other fields must be specified using 2 digits. Date is specified in YYYY/MM/DD format, and time is entered using 24-hour format. Take note of this time for use in step 3.



```
//  uncomment and update the following lines to set the time/date
//  time setting is sychronized on a button press
CurrentDate=2009/07/01
CurrentTime=14:10:00
```

Figure 2.2. Setting date and time.

Step 2: Insert USB storage device and apply power

Eject the USB storage device and remove it from the computer. Insert the USB device into the SDR2-USB, and connect power. The SDR2-USB will display its usual flashing pattern, then read the setup file and turn on all 4 front-panel LED indicators. If precise setting is desired, monitor a stopwatch or computer clock.

Step 3: Synchronize the SDR2-USB clock

When the stopwatch or computer clock reaches the time specified in step 1, press the record button on the front panel. The SDR2-USB will the operate normally.

Step 4: Re-edit setup.txt

Remove the USB storage device from the SDR2-USB and edit the setup file using Windows Notepad on the PC. Disable the CurrentDate= and CurrentTime= lines by inserting // characters before them. These lines can also be deleted if date/time setting will not be performed again.

2.3 Configuring the data port

Before the SDR2-USB and your data source can communicate, they must interact at the same data rate and using the same data format.

The SDR2-USB's data port is, by default, configured to communicate at 115200 bps.

If your data source can communicate at 115200 bps (also referred to as 115200 baud), it may be easiest to configure it for 115200 bps. For devices with a fixed data rate, you will need to set the SDR2-USB's data port baud rate to match your data source. You may also wish to choose a higher data rate and hardware handshaking if your data source sends a high volume of data.

NOTE: By default, the SDR2-USB uses a serial data format of eight data bits, no parity, and one stop bit (8N1). Most serial devices use this format.

Hardware handshaking prevents a data source from sending data when the SDR2-USB is not ready to receive it – the SDR2-USB can "shut off" the transmitting data source if, for example, the USB storage media is slow or not present.

Be sure that your serial data source and the SDR2-USB use the same handshaking settings. If your data source monitors the handshaking signals but the SDR2-USB doesn't send the appropriate signal, the software may never transmit data.

To change the baud rate for the data port, add the line DataPortBaud= to the setup file as in Figure 1.4. Common baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps, although the SDR2-USB can handle "nonstandard" baud rates as well.

To enable hardware handshaking, include the line DataPortHandshake= in in the file, with a value of 1 for enabled or 0 for disabled.

Finally, while 8N1 communication is used by the vast majority of data sources, some devices communicate using nonstandard data word formats such as 7E1. To specify this, add the line DataPortWordFormat= to the setup file, with a value of 8N1, 7E1, etc.

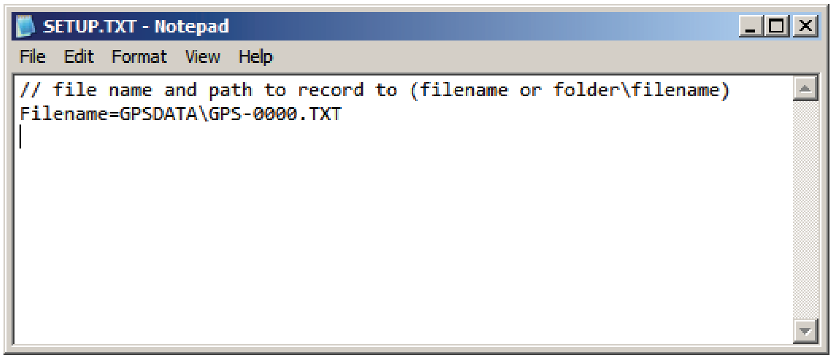
2.4 Specifying a filename and folder

By default, the SDR2-USB records data to a file called `SDR-0000.DAT` located in the `DATA` subfolder in the storage device's root directory. You can keep this filename or specify a new filename that reflects the data it contains. For example, you may wish to use `PRESSURE.TXT` for pressure data or a name like `TEMP1109.TXT` for temperature data from November 2009. Likewise, your choice of folder names may reflect something about the data it contains.

Notes about filenames

When you specify a filename, it must conform to the FAT 8+3 filename format. This means that files contain up to 8 characters, a period ("dot"), and up to three more characters. For example, `BRIDGE.DAT`, `ABCDEFGH.123`, and `1` are all valid filenames, while `DATA.FILE`, and `JOHNSMITH.TXT` are not. The SDR2-USB ignores characters you type that are not allowed in FAT16 filenames, such as: **`\/*|[]`**. Specifying illegal characters can sometimes result in unpredictable filenames.

To specify the name of the file the SDR2-USB will use for recording data, include the line Filename= in your setup file and specify a folder and filename after the equals sign. For example, to record to a folder named "GPSDATA" and use a filename of "GPS-0000.TXT", include the line Filename=GPSDATA\GPS-0000.TXT (see Figure 2.3).



```
// file name and path to record to (filename or folder\filename)
Filename=GPSDATA\GPS-0000.TXT
```

Figure 2.3. Specifying filename and folder for recording.

2.5 Configuring file creation behavior

Be default, the SDR2-USB creates a new file in the recording folder every time recording is initiated, generating a new, unique filename based on the previous filename. To instruct the SDR2-USB to always append data to the existing file when recording starts, add the line Append=1 to the setup file.

The SDR2-USB can also be configured to periodically restart recording based on file size, a period of time in seconds, or at specific times of day. Use the line Fileclose= to enable this periodic scheduled file closing, and FileCloseBytes=, FileCloseSeconds=, or StartTime= and StopTime= to enable one of these modes (see section 4.1.4 for more details).

Finally, the SDR2-USB can be configured to overwrite the oldest file found in the recording directory if necessary. When this mode is enabled, the SDR2-USB will delete the oldest file on the disk whenever recording starts and the storage media has less than 1 megabyte of free disk space.

Use this option with scheduled file closing to configure the SDR2-USB as a circular buffer that contains only the most recently received data. To enable overwrite-oldest mode, include the line OverWriteOldest=1 in the setup file.

2.6 Adding time stamps to recorded files

Along with file creation and last-modified dates, many users want to record date and time information as data is received. Date and time stamps can be logged along with incoming data and triggered either when a specific data byte is received or when a gap in the data stream is detected.

Date/time stamping is commonly used for ASCII (human-readable) text data. Lines of text end with a line feed character (ASCII code 10). Enable the SDR2-USB's time stamping feature by adding the line Timestamp=1 to the setup file. Then, instruct the recorder to add a time stamp after a line feed is received by adding the line TimestampTrigger=10. The recorder will be "armed" to time stamp when a line feed is received, then insert a stamp when the **next** character is received— at the start of the next line.

It is common to encounter a data source that periodically outputs "bursts" of data with time gaps between the bursts. For example, a GPS receiver outputs a position report once/second, then sits idle between reports. For this scenario, it is convenient to configure the recorder to insert a time stamp after any gap in the data stream. To specify this behavior, add the line TimeStampTrigger=gap to the setup file.

Custom time/date stamp formats are also available and can include millisecond-precision stamping. See section 4.1.5 for more details on custom date/time stamps.

2.7 Testing your configuration

To test your configuration, use a null modem adapter or cable to connect a computer running terminal software (e.g. Windows HyperTerminal) to the SDR2-USB's data port. Your computer then becomes a data source.

Press the Record button to enter record mode. The SDR2-USB's record indicator will illuminate.

To ensure that recording is occurring, type several keystrokes on the terminal or use the software's ASCII text upload feature to send a text file. The SDR2-USB's data indicator should blink as you press keys, indicating data is being received. When finished, press the record button again to stop recording and inspect the file created on the USB storage device.

Note: The SDR2-USB will not echo data while it is being recorded, so you will not see characters appear on-screen as you type. You can enable your terminal software's "local echo" or "full duplex" feature to view data as you send it.

3

Operations

3.1 Setup file reading

The setup.txt file on the USB storage device is read only when power is applied to the SDR2-USB. Once read, all settings found in setup.txt are retained by the recorder.

3.2 Record mode operation

When you press the record button, the SDR2-USB searches for the current file specified in the setup file, creates it if necessary, and opens it. Once the SDR2-USB has successfully opened the file, the record indicator turns on and the SDR2-USB enters record mode. Once in record mode, the SDR2-USB records any data received on the data port to the open file.

3.2.1 Receiving data

The data indicator flashes when the SDR2-USB receives data. This indicator is useful to ensure that the SDR2-USB is actually receiving data via the data port. Note: this flashing indicator does <u>not</u> guarantee a correct baud rate. Incorrect baud rates between the data source and SDR2-USB may still cause the data indicator to flash and invalid data to be written to the current file.

3.2.2 Stopping recording

Incoming data is written to the open file as it is received until you stop recording by pressing the record button. The SDR2-USB then closes the file, updates its directory entry (recording file size, date, and time), and returns to stop mode.

3.2.3 Device removal while recording

Do not terminate recording by removing the USB storage device without stopping the recorder, or disk corruption may occur.

3.2.4 Power failure and improper shutdowns

If the SDR2-USB loses power while in record mode, it returns to record mode after power is restored.

An improper shutdown may result in loss of data (due to sector buffering and caching in the storage device) and minor allocation errors that can be repaired using the Windows 95/98/NT/2000/XP/Vista™ Explorer or chkdsk.exe from the Windows Command Prompt.

3.2.5 Filename generation

When operating with Append=0 (see section 4.1.3), unique new filenames are generated based on the specified filename. This is done to avoid overwriting an existing file within the specified folder.

Filenames are generated by "incrementing". Before incrementing, the file's name is extended to 8 characters with a sequence of zeros. From there, the filename's last character is incremented through the digits 0-9 and A-Z, carrying to the next-last as needed. An example of incrementing is shown in Figure 3.1.

Before Incrementing	After Incrementing
BRIDGE.DAT	BRIDGE01.DAT
BRIDGE01.DAT	BRIDGE02.DAT
BRIDGE09.DAT	BRIDGE0A.DAT
BRIDGE0Z.DAT	BRIDGE10.DAT
BRIDGE10.DAT	BRIDGE11.DAT

Figure 3.1. Generating filenames when append mode is off.

3.2.6 Full storage media

When the storage media's first valid partition is full, the SDR2-USB returns to stop mode unless overwrite-oldest mode is enabled, in which case the SDR2-USB will delete the oldest file in the target folder and return to recording mode.

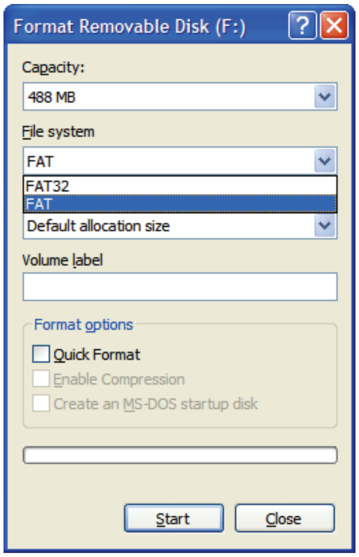
Delete files on the target media using your computer or replace the media, then insert and press the record button to record data normally.

3.2.7 Formatting the storage media

If you have purchased a USB storage device, you may need to format it using MS-DOS™, Windows 95/98/ME™, Windows NT/2000/XP™, or another operating system that supports the FAT file system.

The SDR2-USB supports **only** the FAT and FAT32 file systems. If your computer supports the NTFS, HPFS, or other advanced file systems, be sure your card is formatted using FAT or FAT32.

NOTE: If your USB storage media was included with SDR2-USB, it is already formatted properly.



Format Removable Disk (F:)

Capacity: 488 MB

File system: FAT

FAT32
FAT

Default allocation size

Volume label

Format options

☐ Quick Format
☐ Enable Compression
☐ Create an MS-DOS startup disk

Figure 3.2. Formatting a small USB memory key using the FAT file system.

3.2.8 Partitions

In some cases, disks are partitioned to contain multiple "virtual" drives on a single disk. Partitioning is sometimes done to overcome the 2 gigabyte size limit in MS-DOS™ (and create multiple 2 gigabyte drives), support multiple operating systems and file systems, or make more efficient use of disk space.

FDISK.EXE (included with MS-DOS™ and Windows 95/98™), Disk Administrator (included with Windows NT/2000/XP/Vista™), Norton Disk Doctor™, and Norton DiskEdit™ are useful tools for managing and analyzing disk partitioning schemes.

The SDR2-USB supports both extended and primary FAT partitions, but always reads and writes files in the first partition it recognizes as a FAT partition.

3.3 Lithium battery maintenance

The SDR2-USB's real-time clock uses a small lithium battery to maintain time when external power is unavailable. The life of this battery should exceed 5 years.

If you find your SDR2-USB is not keeping time correctly when power is lost, you may need to replace the battery. If necessary, replace the battery with a Panasonic CR2032, or equivalent, making sure the positive (+) face is in contact with the battery clip. After replacing the battery, be sure to reset the SDR2-USB’s time and date.

3.4 Resetting to factory defaults

The SDR2-USB can be reset to factory defaults by removing the USB storage device, holding the record button, and connecting power. Once power is connected, the record button must be held for 5 seconds until the flashing pattern is displayed on the front panel LEDs.

Resetting to factory defaults overrides all settings that have been changed via the setup file.

4 Setup File Reference

All SDR2-USB configuration is performed via the setup.txt file in the root folder of the USB storage device. The setup file is read only when power is connected to the SDR2-USB, and all settings specified within the setup file are retained by the recorder indefinitely.

4.1.1 Initial Setup Commands

The CurrentDate= and CurrentTime= setup file lines are used during one-time initial setup to set the real-time clock's time and date values. After including these lines in the setup file, power up the SDR2-USB and press the record button to synchronize the clock, then re-edit the setup file, erasing or commenting-out the lines for future use.

CurrentDate: Use this command to set the real-time clock's date. Date must be specified in YYYY/MM/DD format (e.g. 2009/06/30 for 30 June 2009).

CurrentTime: Use this command to set the real-time clock's time. Time must be specified in 24-hour HH:MM:SS format (e.g. 14:49:00 for 2:49 PM).

```
// uncomment and update these 2 lines to set the time
// time setting is synchronized on a button press
CurrentDate=2009/06/30
CurrentTime=14:49:00
```

4.1.2 Data Port Setup Commands

DataPortBaud (default=9600): Use this setup file command to specify a bits/second rate for communication with your data source. Industry-standard baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, and 230400 bps. The SDR2-USB can also handle nonstandard rates including 460800 and 961600 bps.

DataPortWordFormat (default=8N1): This command changes the SDR2-USB's data bits, parity, and stop bits. To specify the most common setting, set this value to "8N1", meaning eight data bits, no parity, and one stop bit. Other possible values include seven data bits, odd/even parity (O/E), and one or two stop bits, resulting in the following permutations: 8N1,8N2,7E1,7E2,7O1,7O2,8E1,8O1.

DataPortHandshake (default=0): Use this setup file command to turn hardware handshaking on or off. When enabled, the SDR2-USB will drive its RTS signal low when the USB media isn't present and internal data buffer space is exhausted. When disabled, the RTS signal will remain high regardless of the SDR2-USB's state.

```
// data port baud rate (50-921600)
DataPortBaud=9600
// data port word format (8 data bits, no parity, 1 stop bit)
DataPortWordFormat=8N1
// data port handshaking (0=off)
DataPortHandshake=0
```

4.1.3 Recording Behavior Commands

Filename (default=DATA\SDR-0000.DAT): The Filename command sets both the location and name of the file to be recorded. To specify a folder for data storage (recommended), precede the filename with a folder name and backslash. To record files to the media's root folder, simply specify a filename. The SDR2-USB uses this filename for the first file that's recorded— subsequent files are given unique names based on this name.

Append (default=0): Use the Append command to control whether the SDR2-USB creates new files each time recording restarts. When Append=1, the SDR2-USB adds data to the existing file. When Append=0, the SDR2-USB creates a new file with unique filename any time recording starts (see section 3.2.5).

FlushBuffer (default=0): Use the FlushBuffer command with a value of 1 to configure the SDR2-USB to record only data that is received after recording starts. When FlushBuffer is 0, the recorder can buffer several seconds of data while recording is stopped, allowing time to exchange media if needed.

ForceRecording (default=0): ForceRecording=1 configures the SDR2-USB to always record if storage media is present and ignore the front-panel button. This setting is useful for guaranteeing data is recorded.

OverWriteOldest (default=0): Use OverWriteOldest=1 to configure the SDR2-USB to overwrite the oldest file in the destination recording folder if possible when space available on the storage media is exhausted. Together with scheduled file closing, this option can be used to configure the SDR2-USB as a circular buffer— as the disk fills, the oldest file is overwritten.

```
// file name and path to record to
Filename=DATA\GPS0000.txt
// create new files when recording starts
Append=0
// buffer data when stopped
FlushBuffer=0
// always record if media is present
ForceRecording=1
// overwrite oldest file if necessary
OverWriteOldest=1
```

4.1.4 Scheduled File Closing Commands

Scheduled file closing, together with Append=0, allows the user to divide recorded data into files of a more manageable size.

FileClose (default=0): The FileClose setup file line enables and disables scheduled file closing.

FileCloseSeconds: The FileCloseSeconds setting configures the SDR2-USB to close the current file and restart recording after the specified number of seconds. For example, to configure the recorder to restart recording every hour, use FileCloseSeconds=3600 (3600 seconds=60 minutes=1 hour).

FileCloseBytes: The FileCloseBytes setup file line configures the recorder to close the current file and restart recording once the current file reaches the specified number of bytes. For example, use FileCloseBytes=1048576 to configure the SDR2-USB to create a new file if the size reaches 1 megabyte.

StartTime, StopTime: The StartTime and StopTime lines configure the recorder to start and stop at specific times of day (specified in 24-hour HH:MM:SS format). If start and stop times are equal, each file will contain 24 hours of data. FlushBuffer=1 (see above) is usually used if start and stop times are different in order to reject data received while recording was stopped.

```
// enable scheduled file closing
FileClose=1
// record only during business hours
StartTime=08:00:00
StopTime=17:00:00
FlushBuffer=1
```

4.1.5 Time Stamping Commands

The SDR2-USB can insert time and date information into files during recording. Among other things, this is useful for scientific data analysis and historical trending studies.

Timestamp (default=0): The Timestamp setup file line enables date/time stamping.

TimestampTrigger: The TimestampTrigger setup file line specifies a decimal ASCII character that “arms” the time stamping function. Once the trigger character is received, the recorder will insert a time stamp when the **next** byte of data is received. For example, a trigger value of 10 will configure the SDR2-USB to insert a time stamp after a line feed is received.

TimestampTrigger=gap: Specifying a trigger value of “gap” enables a special time stamping mode where the SDR2-USB will detect time gaps in the stream of incoming serial characters and insert a time stamp after the gap. This is useful for data sources such as GPS receivers that output “bursts” of data periodically.

TimestampFormat (default=MM/DD/YYYY hh:mm:ss\20): Use the TimestampFormat command to provide a template for the timestamps as they are inserted into the file. Timestamp field format values are case-sensitive— month, day, and year fields must be specified in capital letters, while hour, minute, second, and millisecond fields must be provided in lower-case letters. Escape codes are used to insert characters such as spaces, line feeds, carriage returns, and tabs. To include an escape sequence, use a backslash followed by the two-digit hexadecimal ASCII code for the character to use (e.g. \0A for a line feed or \20 for a space).

```
// enabled time stamping
Timestamp=1
// trigger on a line feed
TimestampTrigger=10
// include milliseconds and 2-digit year in time/date stamp
TimestampFormat=MM/DD/YY hh:mm:ss.ddd\20
```

4.1.6 Other Commands

DisableIndicators (default=0): Use a setup file line with DisableIndicators=1 to turn front-panel LED indicators off. When enabled, the indicators will flash occasionally in a “heartbeat” pattern. Use this setting to save small amount of power and/or avoid user confusion.

5

J4 Remote Control Port

5.1 Overview

The SDR2-USB's J4 remote connector allows for starting and stopping recording via external switches/buttons or TTL/CMOS digital logic. The J4 connector also provides alternate outputs for the front-panel fault, data, and record indicators.

5.2 Location

The J4 connector is located next to the J1 power input connector on the SDR2-USB's internal circuit board.

5.3 Functions

Table 5.1 describes the functions of the J4 remote connector.

V_{DD} (3.3VDC)	Regulated low-current voltage output. Use for deasserting active-low inputs and driving LED indicator outputs.
GND (0 VDC)	Signal ground. Use for asserting active-low inputs.
$\overline{\text{REC\_BUTTON}}$	Momentary record input. Function is similar to front-panel record button. To use, connect a momentary pushbutton switch between this contact and GND.
$\overline{\text{REC\_TOGGLE}}$	Force-record input. To use, connect a toggle switch between this contact and GND. When closed, the SDR2-USB will always enter record mode.
$\overline{\text{FAULT}}$	Fault condition indicator output. Function is similar to the front-panel Fault indicator. When low, indicates an unrecoverable error has occurred in the SDR2-USB. To use, connect an LED's cathode to this contact and its anode to V_{DD} via a current-limiting resistor. Limit current to 10 mA max.
$\overline{\text{DATA}}$	Data indicator output. Function is similar to the front-panel Data indicator. Pulses momentarily low to indicate data reception in the SDR2-USB. To use, connect an LED's cathode to this contact and its anode to V_{DD} via a current-limiting resistor. Limit current to 10 mA max.
$\overline{\text{RECORD}}$	Recording indicator output. Function is similar to the front-panel Record indicator. Driven low when the SDR2-USB is recording data to an open file. To use, connect an LED's cathode to this contact and its anode to V_{DD} via a current-limiting resistor. Limit current to 10 mA max.

Table 5.1. J4 remote control port pin functions.

5.4 Pinout and Mating Cable

The J4 connector is a 2mm 10-pin connector housing that mates to a Hirose DF11-10DS-2C shell (Digi-Key part number H2023-ND). A pre-built J4 cable is available from Acumen Instruments Corporation on request.

Contact	Function	Direction	Wire Color
1	V_{DD} (3.3 VDC)		-
2	GND (0 VDC)		Black
3	$\overline{\text{REC\_BUTTON}}$	input	Blue
4	$\overline{\text{REC\_TOGGLE}}$	input	Grey
5	$\overline{\text{FAULT}}$	output	Yellow
6	no connect		-
7	$\overline{\text{DATA}}$	output	Orange
8	$\overline{\text{RECORD}}$	output	Green
9	V_{DD} (3.3 VDC)		-
10	GND (0 VDC)		-

Table 5.2. J4 remote control port pinout.

J4 mating plug (shell): Hirose DF11-10DS-2C (Digi-Key part number H2023-ND)
For use with DF11 crimp contacts e.g. DF11-2428SCA (Digi-Key part number H2300-ND) or pre-crimped wires (Digi-Key part number H3BXG-101*LL-CW* where LL=length in inches, C=color code, W=wire gauge code).

5.5 Force-Record Shunt Installation

The SDR2-USB can be forced into record mode any time power is applied and USB storage is present. To use this mode, install a 2mm shunt between J4 pins 4 (REC_TOGGLE) and pin 2 (GND).

A good choice of shunt is Norcomp part number 810-002-SP2L001 (Digi-Key part number SP2-001E-ND).

6

Service and Support

6.1 Exception Codes

The following are common error codes encountered when using DataBridge SDR2-USB products. To determine which error has occurred, watch the "exception" indicator on the SDR2-USB's front panel and count the number of rapid blinks. Each sequence is separated by a 1 second pause in the blink pattern.

Exception 2: Root Directory Full

A FAT (FAT16) root directory can have only 512 directory entries (fewer if long filenames are used). Delete files from the root directory, record to a subfolder in the root directory, or use FAT32 formatting to overcome this limitation.

Exception 3: Disk Full

The disk has no (or almost no) available space for files. Delete files from the disk to ensure space is available.

Exception 4: Bad Boot Record

Occurs when the disk is completely unformatted or formatted for an unsupported file system.

Use `format /FS:FAT` from the Windows command prompt to ensure proper FAT formatting.

Exception 5: Hardware Error

Usually occurs when the SDR2-USB cannot reset the USB storage device. Try ejecting and reinserting the card or using a new card and contact Acumen if problem persists.

Exception 6: EEPROM Error

Rare hardware error. Contact Acumen to discuss repair or replacement.

Exception 7: Cache Error

Rare hardware error. Contact Acumen to discuss repair or replacement.

Exception 8: Buffer Error (firmware error)

Rare error that may occur in customized or beta firmware versions. Contact Acumen to report.

Exception 9: Tasking Error (firmware error)

Rare error that may occur in customized or beta firmware versions. Contact Acumen to report.

Exception 10: USB Error

The USB storage media has reported a fatal error to the SDR2-USB.

Reinsert/replace the media and contact Acumen if problem persists.

Exception 11: Directory Creation Error

Rare. The SDR2-USB cannot create the subdirectory files are to be recorded to. Try using a different directory name or reformatting the media.

Exception 12: FAT12 File System Detected

The SDR2-USB has determined that the USB media was formatted using the FAT12 file system, which is unsupported. Reformat the USB storage device using the /A:512 option (Windows 2000/XP) and retry.

6.2 Contacting Acumen Instruments Corporation

6.2.1 Technical support

Service and technical support can be reached between the hours of 9AM and 5PM (Central Standard Time) Monday through Friday. Acumen Instruments Corporation can be reached at the following phone numbers:

(515) 296-5366 (voice)
(515) 296-3554 (fax)

6.2.2 U.S. Mail

Acumen Instruments Corporation can be reached by mail at:

Acumen Instruments Corporation
2625 N. Loop Drive Suite 2200
Ames, IA 50010
USA

6.2.3 E-mail

Acumen Instruments Corporation can be reached via e-mail at:

info@acumeninstruments.com

6.2.4 World Wide Web

Acumen Instruments Corporation maintains a web site containing product information and downloads:

http://www.acumeninstruments.com

6.3 Returning Equipment

Before returning equipment to Acumen Instruments Corporation, please call for an RMA number and shipping information. This allows us to plan for your shipment in order to provide the best possible service. When returning equipment, please include a note indicating the symptoms of the failure and any other pertinent information.

6.4 Warranty

6.4.1 One year warranty

Acumen Instruments Corporation warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. During the warranty period, Acumen Instruments Corporation will, at its option, either repair or replace products that prove to be defective.

6.4.2 Exclusions

This warranty shall not apply to any defect, failure or damage caused by misuse, abuse, improper application, alteration, accident, disaster, negligence, use outside of the environmental specifications, improper or inadequate maintenance, or incorrect repair or servicing not performed or authorized by Acumen Instruments Corporation.

6.4.3 Limitations

ACUMEN INSTRUMENTS CORPORATION SHALL IN NO EVENT HAVE OBLIGATIONS OR LIABILITIES TO BUYER OR ANY OTHER PERSON FOR LOSS OF PROFITS, LOSS OF USE OR INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, OR ANY OTHER THEORY OR FORM OF ACTION, EVEN IF ACUMEN INSTRUMENTS CORPORATION HAS BEEN ADVISED OF THE POSSIBILITY THEREOF, ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY, USE, REPAIR, OR PERFORMANCE OF THIS PRODUCT (INCLUDING EQUIPMENT, DOCUMENTATION AND SOFTWARE). IN NO EVENT SHALL THE LIABILITY OF ACUMEN INSTRUMENTS CORPORATION ARISING IN CONNECTION WITH ANY PRODUCT EXCEED THE ACTUAL AMOUNT PAID FOR SUCH A PRODUCT.

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A

Serial Port Basics

A.1 Serial specifications

Serial data is any data that is sent one bit at a time using a single electrical signal. In contrast, *parallel data* is sent 8, 16, 32, or even 64 bits at a time using a signal line for each bit. Data that is sent without the use of a master clock is said to be *asynchronous serial* data.

Several communications standards exist for the transfer of asynchronous serial data. Common PC's transfer data using the EIA RS-232C (also known as V.28 or V.24). Updated versions of this standard include RS-232D and EIA/TIA-232E, but most literature still refers to the RS-232C or RS-232 standard.

Other asynchronous serial standards in common use include RS-422, RS-423, and RS-485. These standards allow higher data rates and longer cable lengths than RS-232 and are common in industrial settings.

A.2 Data rates

The *baud rate* for a serial connection is the number of bits that are transmitted per second. It is specified in bits/second or baud. For example, a 9600 baud serial link transfers 9600 bits per second.

The EIA RS-232C standard permits data rates up to 19200 bps and cable lengths up to 400 meters (but not both).

data rate	maximum	distance
(bps)	(meters)	(feet)
19200	15	45
9600	25	76
4800	50	152
2400	100	304
1200	200	608
600	400	1216

Table A.1. Data rates and distances for RS-232 communications.

Although the specification only defines rates up to 19200 bps, communication using data rates as high as 230400 bps and a short (<2 meter) cable are common. Standard modems communicate with computers at up to 115200 bps.

As you may have guessed, the use of high baud rates requires more capable computer hardware. At high baud rates, a computer must process as many as 23000 characters per second. The constant attention a computer must pay to its serial port makes this problematic particularly in multitasking environments such as Microsoft Windows 3.1/95/98/NT/2000.

A.2.1 Data rates and the UART

Computer hardware designers solve this problem by allowing the computer to respond to characters less frequently. A Universal Asynchronous Receiver/Transmitter (UART), the component responsible for communicating via RS-232, may contain several bytes of memory called a FIFO (first-in, first-out memory).

The original IBM PC (and many of its successors) used the 8250 UART, which contained no FIFO. That is, a computer with 8250 (or 16450) UART's must respond to every incoming character.

Newer PC's incorporate the 16550 UART or a variant. The 16550 incorporates a 16-byte FIFO and is **mandatory** for communications at speeds above 9600 bps and is important for error-free communications at lower speeds as well.

You can find out which type of UART's your computer uses by using the MSD.EXE tool provided with DOS and Windows or by looking in the Windows 95/98 control panel.

A.3 More asynchronous serial parameters

In most cases, the data rate in bytes/second can be approximated by dividing the baud rate (in bits/second) by 10. If a byte consists of 8 bits, why divide by 10?

To transfer data asynchronously, the UART *frames* the 8 data bits between a stop bit and a start bit. The start bit is always a zero, while the stop bit is always a one. So, a byte of data sent serially is made up of 10 bits instead of the usual 8.

Asynchronous serial devices can communicate using 7 or 8 data bits, and 1, 1½, or 2 stop bits. To further complicate matters, devices can also employ a *parity* bit instead of an eighth data bit to check for errors. Even parity systems transmit a one when the sum of the seven bits is an even number, while odd parity systems transmit a one when the sum is odd. Still more exotic systems may specify "mark" or "space" parity, where the parity bit is always a one or zero, respectively.

What does all of this mean? Device vendors usually specify their data rate and format using statements like "9600, 8N1", which translates to 9600 bps, 8 data bits, no parity, and 1 stop bit or "19200, 7E1", which translates to 19200 bps, 7 data bits, even parity, and 1 stop bit.

NOTE: Most serial devices format of eight data bits, no parity, and one stop bit (8N1).

A.3.2 DTE and DCE

The RS-232 specification defines two classes of devices: data terminal equipment (DTE) and data communication equipment (DCE). Your computer's serial port is configured for DTE operation, since the computer acts as a terminal. Modems and many other serial devices are configured as DCE, since they are communications equipment.

What's the difference? A DTE device's TD signal means "I transmit data on this line." A DCE's TD signal can be read "You (the DTE) transmit data to me on this line." A DTE's RD signal means "I receive data on this signal line." A DCE's RD line means, "You, the DTE, will receive the data I transmit on this signal line." Sound confusing?

A look at a the DB9 connector pinouts and signal direction with respect to DTE (e.g. your computer) makes things a little more clear.

		pin number		
signal name		**25-pin**	**9-pin**	**direction**
transmitted data	**TD**	2	3	DTE→DCE
received data	**RD**	3	2	DTE←DCE
request to send	**RTS**	4	7	DTE→DCE
clear to send	**CTS**	5	8	DTE←DCE
data terminal ready	**DTR**	20	4	DTE→DCE
data set ready	**DSR**	6	6	DTE←DCE
data carrier detect	**DCD**	8	1	DTE←DCE
ring indicator	**RI**	22	9	DTE←DCE
signal ground	**GND**	7	5	

Table A.2. Pinouts for 9-pin and 25-pin serial connectors.

The cable that connects DTE devices (such as your computer) and DCE devices (such as your modem) is simple. It connects the TD pin to TD, pin RD to RD, etc. A cable that connects DTE to DTE or DCE to DCE must connect the TD to RD and RD to TD. This cable is referred to as a *null* *modem* cable because it can connect two terminals (DTE's) without the use of modems (DCE's). Note that GND pins are always connected.

Most devices have female connectors (DB9 or DB25) if they are configured for DCE operation and male connectors if they are configured for DTE operation, but this is not always the case.

There is a simple trick for determining whether a device is DTE or DCE. Connect a voltmeter's ground line to the connector's GND pin. Then, probe the voltage on the TD and RD pins. If the TD pin voltage is small (-3V<Vin<+3V), the device is configured to receive data on the TD pin, and thus is a DCE device. Likewise, if the RD pin voltage is small, the device is receiving data on the RD pin, and thus is DTE.

A.3.3 Handshaking

Handshaking signals by the receiving device to tell the transmitter "I am ready for data" or "I am not ready for data." These signals are optional: the receiver may always be ready for data or may choose to simply discard data it couldn't process.

A DTE device asserts the "request to send" (RTS) signal when it is ready to receive data and deasserts it when it cannot accept data. Likewise, a DCE device asserts "clear to send" (CTS) when it is ready to receive data. The RTS and CTS signals form a *handshaking pair*, and their use constitutes *RTS/CTS handshaking*.

The "data terminal ready" (DTR) signal, asserted by the DTE, and the "data set ready" (DSR) signal, asserted by the DCE serve similar functions and constitute *DTR/DSR handshaking*. A DTE or DCE devices may employ either or both forms of handshaking. Often, deasserting RTS or CTS signals "micro" events, such as a buffer that is full but will be empty soon, while deasserting DTR or DSR may signal "major" events such as that power has not been applied.

RTS/CTS handshaking and DTR/DSR handshaking are both referred to as *hardware handshaking*. Another form of handshaking, XON/XOFF or *software handshaking*, requires that the receiver send a character (Control-S, ASCII 19) to halt data transfer and another character (Control-Q, ASCII 17) to resume transfer. Although this method eliminates the need for the RTS, CTS, DTR, or DSR signals, it suffers from slow response time by the receiver and renders 2 characters of the 256-character ASCII set unusable.

A.3.4 Voltage levels

For noise immunity and long cable lengths, RS-232 devices convert TTL/CMOS-level signals (0V=logic zero, +5V or +3.3V=logic one) to higher voltage bipolar signals. For the TD and RD signal lines, RS-232 devices use a voltage between –3V and –25V to transmit a one and a voltage between +3V and +25V to transmit a zero. For the other signal lines (RTS, CTS, etc.), RS-232 devices use +3V to +25V to assert the signal and –3V to –25V to deassert the signal. These voltage levels are defined in the EIA/TIA-232E specification. So, when a DTE devices drives RTS at –9.50V, it is signaling the DCE to stop sending data.

A few devices, particularly devices that communicate at low data rates or over short cables, bypass the voltage conversion altogether. These devices often require “computer interface kits” that are really no more than a level converter in a box. These serial ports are often referred to as TTL RS-232, CMOS RS-232, or 5 Volt RS-232 ports and require level converters to interact with computers and other serial devices.

B

B Specifications

B.1 Electrical specifications

SDR2-USB requires a 5 to 30 VDC power source power source via connectors J7 and J1 on SDR2-USB. J1 is inaccessible on the SDR2-USB without removing the enclosure.

NOTE: The SDR2-USB datasheet contains further specifications. All specifications shown in this section may be superseded by the datasheet.

Recording Mode	+12 VDC	see data sheet
Idle	+12 VDC	

Table B.1. DataBridge SDR2-USB power consumption with Kingston 1GB USB flash key installed.

B.1.5 J7 rear power receptacle pin configuration

pin	Function
tip	+5 to +30 VDC
ring	Ground

Table B.2. The SDR2-USB rear power receptacle pin configuration.

B.1.6 J1 power receptacle pin configuration

pin	Function
1	+5.0 to +30 VDC
2	Ground

Table B.3. The SDR2-USB internal power receptacle pin configuration.

B.2 Serial communications

Serial Port	
electrical interface compliance	EIA/TIA-232E and V.28
data rates	50 to 921600 baud
data bits	7 or 8
stop bits	1 or 2
Parity	None, even, odd
Handshaking	RTS/CTS, none

Table B.4. Serial communications specifications for the SDR2-USB.

B.3 USB socket

Socket Type	USB "A" receptacle
storage capacity	limited only by storage device and file system

Table B.5. USB socket specifications for the SDR2-USB.

B.4 Mechanical Specifications

SDR2-USB

Dimensions	3.35" L x 3.76" W x 1.18" H (85 mm x 96 mm x 30 mm)
Weight (without USB media)	8.0 oz (225.0 grams)
Enclosure Material	Aluminum extrusion

Table B.1. SDR2-USB mechanical specifications.

Notes: